

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, comprising the steps of:

forming a silicon oxide film, a silicon nitride film, and an antireflection coating made of a material containing oxygen atoms,  
5 successively on a semiconductor substrate;

patterning said silicon oxide film, said silicon nitride film and said antireflection coating;

performing a reduction treatment for reducing an amount of said oxygen atoms on said antireflection coating;

10 using said antireflection coating after said reduction treatment, said silicon nitride film, and said silicon oxide film as a mask to etch said semiconductor substrate, thereby forming a trench in a main surface of said semiconductor substrate; and

filling said trench with an insulating film.

2. The method of manufacturing a semiconductor device according to claim 1 wherein said reduction treatment is performed by performing a thermal treatment on said antireflection coating in an atmosphere into which a gas containing hydrogen atoms is introduced.

3. A method of manufacturing a semiconductor device, comprising the steps of:

forming a silicon oxide film, a silicon nitride film, and an antireflection coating made of a material containing oxygen atoms,  
5 successively on a semiconductor substrate;

patterning said silicon oxide film, said silicon nitride film, and said antireflection coating;

10 using said antireflection coating, said silicon nitride film, and said silicon oxide film as patterned as a mask to etch said semiconductor substrate using an etching gas with a higher etching rate in a flat portion of an upper surface of said antireflection coating than an etching rate in a facet

portion, thereby forming a trench in a main surface of said semiconductor substrate; and

filling said trench with an insulating film.

4. The method of manufacturing a semiconductor device according to claim 3 wherein said etching gas includes a fluorocarbon-based gas.

5. A method of manufacturing a semiconductor device, comprising the steps of:

forming a silicon oxide film, a silicon nitride film, and an antireflection coating made of a material containing oxygen atoms,

5 successively on a semiconductor substrate;

patterning said silicon oxide film, said silicon nitride film, and said antireflection coating;

10 using said antireflection coating, said silicon nitride film, and said silicon oxide film as patterned as a mask to etch said semiconductor substrate using a gas having a reduction function, thereby forming a trench in a main surface of said semiconductor substrate; and

filling said trench with an insulating film.

6. The method of manufacturing a semiconductor device according to claim 5 wherein said gas having a reduction function includes a gas containing hydrogen atoms, and said trench is formed by etching said semiconductor substrate while deoxidizing said antireflection coating.